

WHAT IS CLAIMED IS:

1 1. An optical waveguide path coupling structure where a
2 first optical waveguide path including a first core layer and a
3 second optical waveguide path including a second core layer are
4 optically coupled, wherein;

5 said first optical waveguide path arranged on an optical
6 device chip, which has a first cross section formed such that said
7 first core layer is exposed as an oblique plane with a slight angle
8 at an end portion and a second cross section formed in an
9 approximately vertical direction to said first cross section at
10 a position apart from said first cross section by a predetermined
11 distance, and a second optical waveguide path arranged on a base
12 substrate, which has a first cross section formed such that said
13 second core layer is exposed as an oblique plane with a slight
14 angle at an end portion and a second cross section formed in the
15 approximately vertical direction to said first cross section at
16 a position apart from said first cross section by a predetermined
17 distance, are coupled by aligning said first cross sections and
18 said second cross sections.

1 2. An optical waveguide path including a film in which upper
2 and lower surfaces of a core layer are multiply coated
3 respectively by an upper clad layer and a lower clad layer,
4 wherein;

5 a first cross section is formed with a slight angle in an
6 optical path direction at an end portion side of said core layer
7 on said film to expose said core layer, and a second cross section
8 is formed having a predetermined cross angle with said first cross

9 section.

1 3. The optical waveguide path according to Claim 2, wherein
2 said first cross section is a plane approximately perpendicular
3 to a plane of said film.

1 4. The optical waveguide path according to Claim 2, wherein
2 said first cross section is a plane forming a predetermined cross
3 section non-perpendicular to a plane of said film.

1 5. An optical waveguide path comprising a film with a lower
2 clad layer, a core layer, a thin film upper clad layer, and a side
3 clad layer having approximately a same height as said core layer,
4 wherein;

5 said core layer for alignment used as a pattern for alignment
6 is formed on said film other than said core layer and a first cross
7 section is formed with a slight angle to an optical path direction
8 at an end portion side of said core layer for said alignment to
9 expose said core layer for said alignment, and a second cross
10 section is formed having a predetermined cross angle with said
11 first cross section to expose an end surface of said core layer.

1 6. A manufacturing method of an optical waveguide path using
2 a film in which upper and lower surfaces of a core layer are
3 multiply coated respectively by an upper clad layer and a lower
4 clad layer, the manufacturing method comprising the steps of:

5 forming a first cross section with a slight angle to an
6 optical path direction at an end portion of said film;

7 measuring a position of said core layer exposed at said first

8 cross section; and

9 forming a second cross section with a predetermined angle
10 from said optical path direction of said film at a position apart
11 from said position of said core layer by a predetermined distance.

1 7. A manufacturing method of an optical waveguide path using
2 a film in which upper and lower surfaces of a core layer are
3 multiply coated respectively by an upper clad layer and a lower
4 clad layer, the manufacturing method comprising the steps of:

5 forming a metal film pattern on a base substrate;

6 forming said film on said base substrate that includes said
7 metal film pattern;

8 forming a first cross section with a slight angle to an
9 optical path direction of said film by removing a portion of said
10 film on said metal film pattern with ablation processing of an
11 ultraviolet laser;

12 measuring a position of said core layer exposed at said first
13 cross section; and

14 forming a second cross section having a predetermined angle
15 to said first cross section with said laser ablation processing
16 at a position on said metal film pattern apart from said position
17 of said exposed core layer by a predetermined distance.

1 8. A manufacturing method of an optical waveguide path using
2 a film in which upper and lower surfaces of a core layer are
3 multiply coated respectively by an upper clad layer and a lower
4 clad layer, the manufacturing method comprising the steps of:

5 forming a metal film on a base substrate, adhering said film
6 onto said metal film and removing a desirable portion of said film

7 by an ultraviolet laser ablation processing;

8 removing said metal film under said desirable portion of
9 said film by etching;

10 forming a first cross section at an end portion of a pattern
11 for alignment by said core layer with a slight angle to a direction
12 of said pattern for said alignment;

13 measuring a position of said core layer exposed at said first
14 cross section; and

15 forming a second cross section with a predetermined angle
16 from an optical path direction of said film at a position apart
17 from said position of said exposed core layer by a predetermined
18 distance.

1 9. An optical device part with an optical waveguide path,
2 comprising:

3 said optical waveguide path comprising a film in which upper
4 and lower surfaces of a core layer are multiply coated
5 respectively by an upper clad layer and a lower clad layer,
6 wherein;

7 said film is provided on an optical device chip being a major
8 portion of said optical device part and made to be a specular
9 surface having a slope of approximately 45 degrees on an upper
10 portion of a light-emitting surface or a light-receiving surface
11 of said optical device chip, and

12 a first cross section with a slight angle to an optical path
13 direction is formed at an end portion side of said core layer of
14 said film to expose said core layer.

1 10. The optical device part with the optical waveguide path

2 according to Claim 9, wherein a hole filled with resin having
3 approximately a same refractive index as that of said core layer
4 is formed from said specular surface having said slope
5 approximately slanting by 45 degrees to said light-emitting
6 surface or said light-receiving surface of said optical device
7 chip.

1 11. The optical device part with the optical waveguide path
2 according to Claim 9, wherein a metal film is formed on said
3 specular surface having said slope approximately slanting by 45
4 degrees and resin is coated on said specular surface.

1 12. The optical device part with the optical waveguide path
2 according to Claim 9, further comprising: a structure in which
3 a spacer is adhered to said optical device chip and said film is
4 formed on said spacer.

1 13. The optical device part with the optical waveguide path
2 according to Claim 12, comprising: said structure in which said
3 spacer is formed by a transparent medium and said spacer is
4 protruded from said optical device chip.

1 14. The optical device part with the optical waveguide path
2 according to Claim 9, wherein said first cross section is a plane
3 approximately perpendicular to a plane of said optical device
4 chip.

1 15. The optical device part with the optical waveguide path
2 according to Claim 9, wherein said first cross section is a plane

3 with a predetermined angle non-perpendicular to a plane of said
4 optical device chip.

1 16. The optical device part with the optical waveguide path
2 according to Claim 9, wherein;

3 the first cross section with a slight angle to an optical
4 path direction is formed at said end portion side of said core
5 layer of said film to expose said core layer and a second cross
6 section is formed having a predetermined cross angle with said
7 first cross section.

1 17. An optical device part provided with an optical
2 waveguide path comprising a film with a lower clad layer, a core
3 layer, a thin film upper clad layer, and a side clad layer having
4 approximately a same height as said core layer, wherein;

5 said film is provided on an optical device chip being a major
6 portion of said optical device part and made to be a specular
7 surface having a slope of approximately 45 degrees on an upper
8 portion of a light-emitting surface or a light-receiving surface
9 of said optical device chip, and

10 a core layer for alignment used as a pattern for alignment
11 is formed on said film other than said core layer and a first cross
12 section with a slight angle to an optical path direction is formed
13 at an end portion side of said core layer for said alignment to
14 expose said core layer for said alignment, and a second cross
15 section is formed having a predetermined cross angle with said
16 first cross section to expose an end surface of said core layer.

1 18. A manufacturing method of an optical device part with

an optical waveguide path using a film in which upper and lower surfaces of a core layer are multiply coated respectively by an upper clad layer and a lower clad layer, the manufacturing method comprising the steps of:

forming a polymer optical waveguide path on a semiconductor wafer in a process before separating said semiconductor wafer into optical device chips;

performing laser ablation processing to resin of said polymer optical waveguide path with an ultraviolet laser and forming a specular surface with a slope approximately slanting by 45 degrees on an upper portion of a plane being a light-emitting surface or a light-receiving surface of said optical device chip; and

forming a cross section with a slight angle to an optical path direction on an other end portion of said polymer optical waveguide path.

19. The manufacturing method of the optical device part with the optical waveguide path according to Claim 18, wherein the process for forming said polymer optical waveguide path further comprising the steps of:

forming a hole that reaches at least said core layer from said plane being said light-emitting surface or said light-receiving surface on a polymer layer after formation of said polymer layer; and

filling said hole with resin of approximately a same refractive index as that of said core layer.

20. The manufacturing method of the optical device part with

2 the optical waveguide path according to Claim 18, wherein the
3 process for forming the specular surface with the slope
4 approximately slanting by 45 degrees further comprising the steps
5 of:

6 forming a metal film pattern on said upper clad layer of
7 said polymer optical waveguide path; and

8 irradiating said ultraviolet laser in a direction
9 approximately slanting by 45 degrees using a metal film pattern
10 as a mask to perform said laser ablation processing.

1 21. A coupling method of an optical waveguide path that
2 couples a first optical waveguide path comprising a first film
3 with a lower clad layer, a core layer, a thin film upper clad layer,
4 and a side clad layer having approximately a same height as the
5 core layer, and a second optical waveguide path comprising a
6 second film with a similar configuration as the first film,
7 wherein;

8 said first film is provided on an optical device chip and
9 made to be a specular surface having a slope of approximately 45
10 degrees on an upper portion of a light-emitting surface or a
11 light-receiving surface of said optical device chip,

12 a first cross section with a slight angle to an optical path
13 direction is formed at an end portion side of each of said core
14 layers to expose said core layer on said first and second films,
15 and a second cross section is formed having a predetermined cross
16 angle with said first cross section, and

17 a height is made to be said same by putting said first cross
18 section and said second cross section of said second optical
19 waveguide path against said first cross section and said second

20 cross section of said first optical waveguide path and by putting
21 surfaces of said first optical waveguide path and said second
22 optical waveguide path against a reference plane common to both
23 said first and said second optical waveguide paths.

1 22. A coupling method of an optical waveguide path that
2 couples a first optical waveguide path comprising a first film
3 with a lower clad layer, a core layer, a thin film upper clad layer,
4 and a side clad layer having approximately a same height as the
5 core layer, and a second optical waveguide path comprising a
6 second film with a similar configuration as the first film,
7 wherein;

8 said first film is provided on an optical device chip and
9 made to be a specular surface having a slope of approximately 45
10 degrees on an upper portion of a light-emitting surface or a
11 light-receiving surface of said optical device chip,

12 core layers for alignment used as a pattern for alignment
13 are formed on positions corresponding with each other on said
14 first film and said second film other than said core layer, a first
15 cross section with a slight angle to an optical path direction
16 is formed at an end portion side of each of said core layers for
17 said alignment to expose said core layers for said alignment, and
18 a second cross section is formed having a predetermined cross
19 angle with said first cross section to expose an end surface of
20 said core layer, and

21 said first cross section and said second cross section of
22 said second optical waveguide path are put against said first
23 cross section and said second cross section of said first optical
24 waveguide path, and said thin film upper clad layer of said first

